NATURE OF THE CHANGES IN THE TENDINOUS REFLEXES IN ATHLETES

A. A. Krobova

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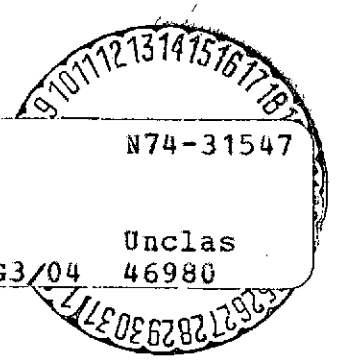

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NATURE OF THE CHANGES IN THE TENDINOUS REFLEXES IN ATHLETES

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(from a dissertation report)

Evaluation of the functional status of the central nervous */290 system, including the reception of the motor apparatus, is a necessary condition for evaluating the capacities of the organism in athletes. The functional state is evaluated on the basis of reflex activity.

Determination of the magnitude of unconditioned reflexes serves as an indication of the changes in the functional states in the nervous system. Among the unconditioned reflexes are the tendinous reflexes,which can be simply and reliably evoked.

In our experiments, we set ourselves the task of studying the changes in the tendinous reflexes as a function of the nature, duration and intensity of muscular activity. On the basis of the changes in the reflexes, an idea could be obtained regarding the changes appearing in the nervous system of an athlete.

The studies were performed on students at the Institute of Physical Culture: track and field athletes, boxers, gymnasts (many of the subjects were members of teams in Moscow) aged 18 to 25. All of the subjects had athletic ratings. Observations were carried out at different times of day. A total of 447 observations were made in the course of two years; 60 observations were made in the laboratory while the rest were made directly at the training sites.

*Numbers in the margin indicate pagination in the foreign text.

Tendinous reflexes occur in response to a blow in the region of the reflexogenic zone (Achilles tendon, close to the point of attachment to the calcaneous and the tendon of the quadriceps muscle of the hip, that part of it which is located above the patella). The stimuli were applied with a special hammer which allowed the force of the blow to be determined. In carrying out the experiments under laboratory conditions, an attempt was made to determine how the tendinous reflexes change under the influence of measured stresses. The magnitude of the stress was varied in terms of volume and was divided into two varieties: (1) 20 and 40 deep knee bends, running in place at a moderate speed for 30 seconds and (2) doing deep knee bends until exhaustion, running in place at a moderate speed for two minutes, and moving the arms upward and to the sides using dumbbells weighing 0.5 kg for one and half minutes.

The experiment was carried out in the following order: the intensity of the reflexes was determined in the subject, after which a previously determined amount of stress was applied; the magnitude of the reflexes was then measured once more, after which the subject was allowed to rest for five minutes. The intensity of the reflexes was then measured again.

Comparison of the data following application of stresses of the first variety with the original values shows that in 24 cases (out of 30) the response reaction showed an increase. The [illegible] /291
increase in reflex responses was different in each of the subjects. /
The fact that the reflex responses increased following slight stresses has been mentioned in the literature. In particular, K. M. Bykov (1935) observed an increase in conditioned reflexes in dogs under the influences of stress. It should be pointed out that this increase was the result of increased stimulability under the influence of the stress.

Following muscular work of the second type, most individuals showed a slight decrease in the intensity of the reflexes. The drop which we observed in the intensity of the reflexes varied as a function of the individual characteristics of the athletes, and on the background of the functional state which existed prior to the experiment. The decrease in responses indicated the development of inhibitory processes in the subjects. The data obtained under laboratory conditions are of interest from the standpoint of the distinctive reaction of the nervous system to a specific stress. We set ourselves the task of testing these laboratory findings and determining how they changed under the influence of training tasks. For this purpose, we observed gymnasts, boxers, and track and field athletes under natural conditions.

We began by studying 50 track and field athletes. The athletes were examined before and after their exercise. It was found that the nature of the training and the magnitude of the stress caused definite changes in the development of tendinous reflexes, indicating changes in the excitability of the central nervous system in those performing the exercises. For example, when we studied medium distance runners, we found the following: the magnitude of the reflexes decreases following training exercises consisting of prolonged uniform running up to 20 minutes, 10 to 15 exercises involving the use of a medicine ball, 15 minutes running on the track and playing basketball. Following these exercises, the majority of athletes showed decreased reflex responses.

All of the participants were found to have an increase in reflex responses following training exercises consisting of athletic exercies (running short distances, various jumps and leaps) the increase in intensity of reflexes varied from one individual

to the next. In the majority of cases, the intensity of reflexes increased in runners going a short distance, jumpers and discus throwers.

60 boxers were also examined. This type of sport is characterized by particular specificity of the stress. Examination of the tendinous reflexes was carried before and immediately after exercise. The training of a boxer involves a wide variety of general development and special exercises. The rate of training is very high. The tendinous reflexes in boxers either increased or decreased. The increases occurred following training exercises composed of exercises aimed at developing speed and learning special boxing techniques. Following the exercises, associated with a great deal of muscular exercise (exercise involving a medicine ball, punching bags, etc.) training bouts in the ring, there was a decrease in the intensity of the reflexes.

We obtained similar results in determining the tendinous reflexes of gymnasts. The order of the tests was not modified. The magnitude of the reflex was determined directly before and after carrying out exercises on the equipment. An increase in the reflexes is observed following those exercises whose performance did not pose great difficulty to the gymnast, i.e., his motor habits were strongly developed. A poorly developed gymnastic combination, learning complicated elements in the majority of cases, produces a decrease in reflex responses, especially in men following performance of exercises on the beam, crossbar and horse with handles.

The results obtained indicate considerable variation in the /292
excitability of the nervous system of the subjects. The combined results of the observations are shown in the chart (see below). In all of the observations, when there was an increase in the

reflex responses, the processes of excitation predominated. Muscular activity as a stimulant of the nervous system can also evoke inhibitory reactions. In these cases the intensity of the reflexes may decrease significantly. According to the observations of V. S. Farfel', reflexes are also markedly reduced, even disappearing in marathon runners following long distance runs.

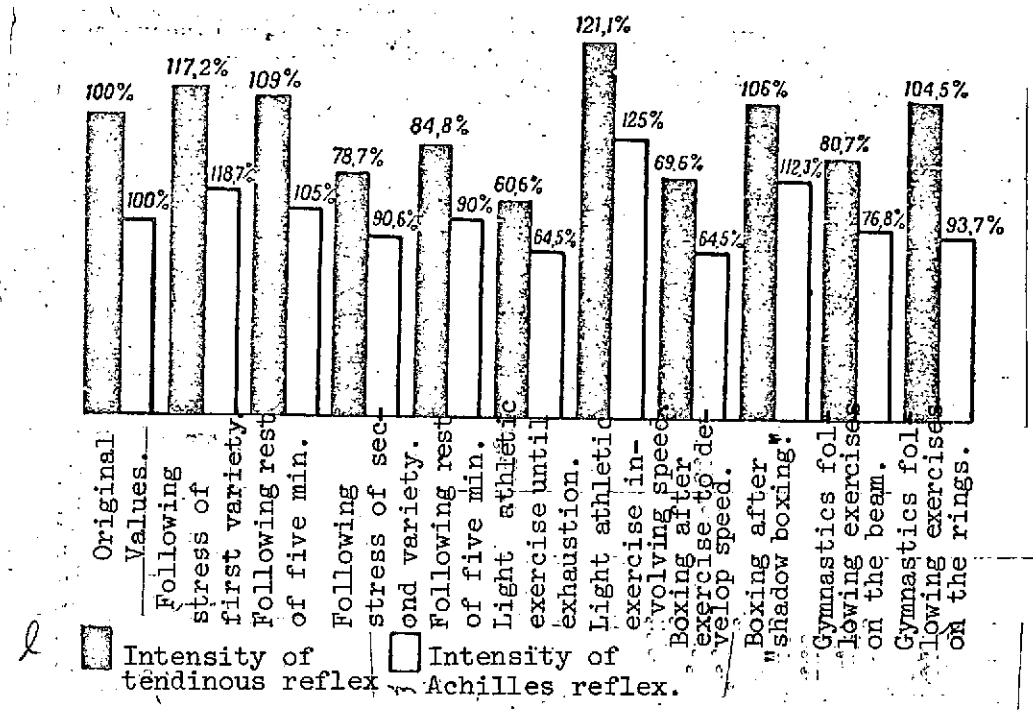
CONCLUSIONS

1. Tendinous reflexes actually reflect the state of excitability of the central nervous system, as indicated by their increase or decrease as a reaction of the nervous system to muscular stress.

2. Under the influence of muscular activity, the intensity of tendinous reflexes increases under the influence of the rapid, brief nature of muscular stress. Prolonged muscular activity, violent exercise and working to exhaustion cause a decrease in reflex responses.

3. These facts enable the reflex reaction of the organism to be used to obtain some idea of the nature of training exercises. It makes it possible to assign on a more effective basis training exercises in terms of speed, effort and tolerance. The method of determining the tendinous reflexes is simple and convenient and accessible to all trainers and athletes.

4. Systematic determination of the magnitude of the tendinous reflexes makes it possible for the trainers and instructors to plot a curve of excitability of the central nervous system, which can be used to establish the optimum period of the state of excitability of the nervous system for a more rational planning of training exercises.


100%
100%
117,2%
118,7%
109%
105%
78,7%
90,6%
84,8%
90%
60,6%
64,5%
121,1%
125%
69,6%
64,5%
106%
112,3%
80,7%
76,8%
104,5%
93,7%
Original Values.
Following stress of first variety
Following rest of five min.
Following stress of second variety.
Following rest of five min.
Light athletic exercise until exhaustion.
Light athletic exercise involving speed.
Boxing after exercise to develop speed.
Boxing after "shadow boxing".
Gymnastics following exercises on the beam.
Gymnastics following exercises on the rings.
Intensity of tendinous reflex
Intensity of Achilles reflex.